Summer 2019

DroughtScape- 2019 Fall

Cory Matteson

DroughtScape

Quarterly Newsletter

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NATIONAL DROUGHT MITIGATION CENTER
UNIVERSITY OF NEBRASKA

Drought Science. Planning Sense.

About the cover photo

2019 marks 20 years of existence of the United States Drought Monitor.

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University of Nebraska Lincoln

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From the Director

Mark Svoboda

We have used this slogan from day one here at the NDMC: "All droughts are local!" As the face of drought, impacts tell us where we are vulnerable to drought and reflect on both the negative and positive effects drought brings to a given location. In turn, we can use this impact information to better tie together risk and vulnerability with drought monitoring/early warning and policy/planning efforts. I think you will find the story on page 11 very informative as we have updated the U.S. Drought Monitor classification table to now include state level impact tables. This type of data will also allow us to better research and understand the relationship between drought impacts and various drought indicators. We anticipate that a variety of users will benefit from the new state-level products.

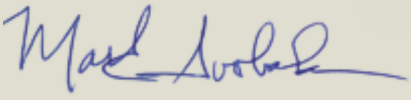
This issue of DroughtScape is also very special to me given we just celebrated the 20th Anniversary of the launching of the U.S. Drought Monitor (USDM) in August. As a co-founder of the USDM back in the late 1990s, it has been a wild ride watching this product adapt and evolve over the years. I liken it to watching my own kids grow up and leave the house after spending 17 years on the hot seat myself. There is a nice write up on some of the USDM history on page 9.

The growth of the USDM over the years has included a strong tie to drought-related programs within the United States Department of Agriculture (USDA) and the Farm Bill. As a result, we have recently worked with USDA to put together a new fact sheet (page 14) detailing the 12 programs currently on the books as well as many other valuable resources.

Finally, it seems like it was only a year or two ago that we launched the Drought Risk Atlas (droughtatlas.unl.edu). The updated launch of the DRA now includes over 1,000 new stations, including 400+ upper elevation SNOTEL sites and 700+ hydrology stations from USGS. Over 500,000 gridded maps will soon follow. You can check out more of the details on page 13.

Speaking of anniversaries, the NDMC will be celebrating our 25th in 2020. Stay tuned for more details on this even in upcoming DroughtScape editions and at drought.unl.edu. In fact, when the next DroughtScape hits the web, it will already be 2020!

Until then, all best,



Near-record heat dominates the Lower 48 and is compounded with record-dry conditions in Southeast to produce flash drought

By Claire Shield
NDMC Climatologist

Drought classifications are based on the U.S. Drought Monitor. Details on the extent and severity of drought are online: ***droughtmonitor.unl.edu****.*

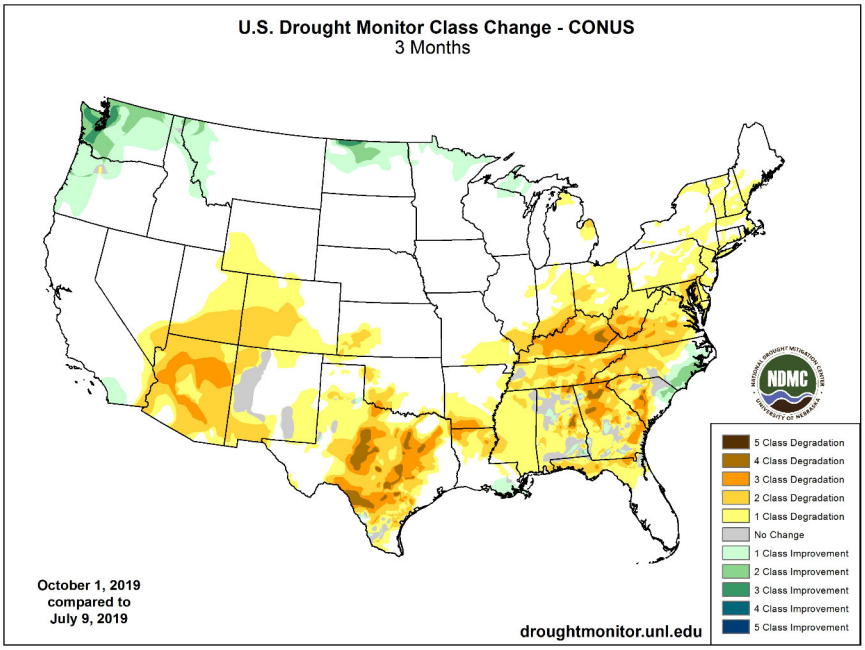
The outlook integrates existing conditions with forecasts from the National Oceanic and Atmospheric Administration's Climate Prediction Center: ***www.cpc.ncep.noaa.gov****.*

National Summary

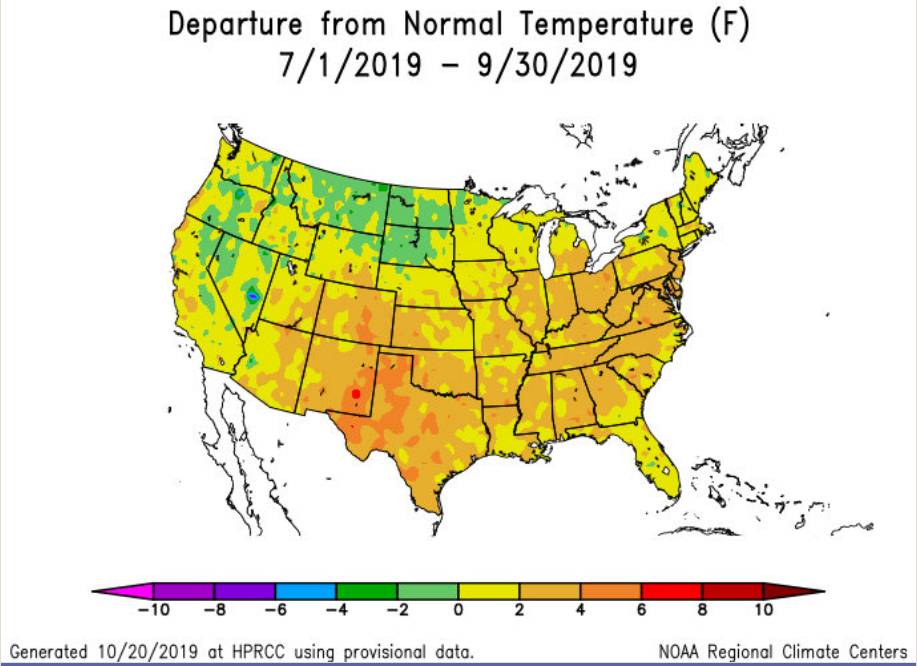
Most of the country was between 1 and 6 degrees warmer than normal during the three-month period with the exception of parts of the West and Northern Plains where temperatures ranged from near normal to 2 degrees below normal. As much as 300% of normal precipitation was found in parts of the West, High Plains, Midwest and South, while the driest conditions compared to normal were found in the Desert Southwest, Texas and the Southeast. Record dry conditions in the Southeast in September were compounded by near-record heat, leading to the development of flash drought.

Drought

Only 3.25% of the country was affected by drought at the beginning of July. By the end of July, there were a few more isolated pockets of abnormally dry and moderate drought conditions throughout the country. Drought had also intensified and spread in Alaska, leaving 6.93% of the country affected by drought. In August, moderate drought appeared throughout parts of the Midwest while drought spread and intensified rapidly throughout Texas and the Desert Southwest. In September, a flash drought began to develop in the Southeast. By the end of the quarter, drought conditions had improved somewhat in the Pacific Northwest,



National Drought Mitigation Center
During the quarter, drought improvement occurred in the Pacific Northwest and Northern Plains while drought conditions appeared and deteriorated in the Southwest, South, and Southeast.



High Plains Regional Climate Center
Warmer than normal conditions were found throughout most of the U.S. Portions of the West, Dakotas, and New England saw slightly cooler than normal conditions.

Alaska and Puerto Rico, but with the deteriorating conditions in the Southwest, South and Southeast, moderate drought coverage rose to 16.96%, and severe and extreme drought coverage increased to 5.3% and 0.8%, respectively.

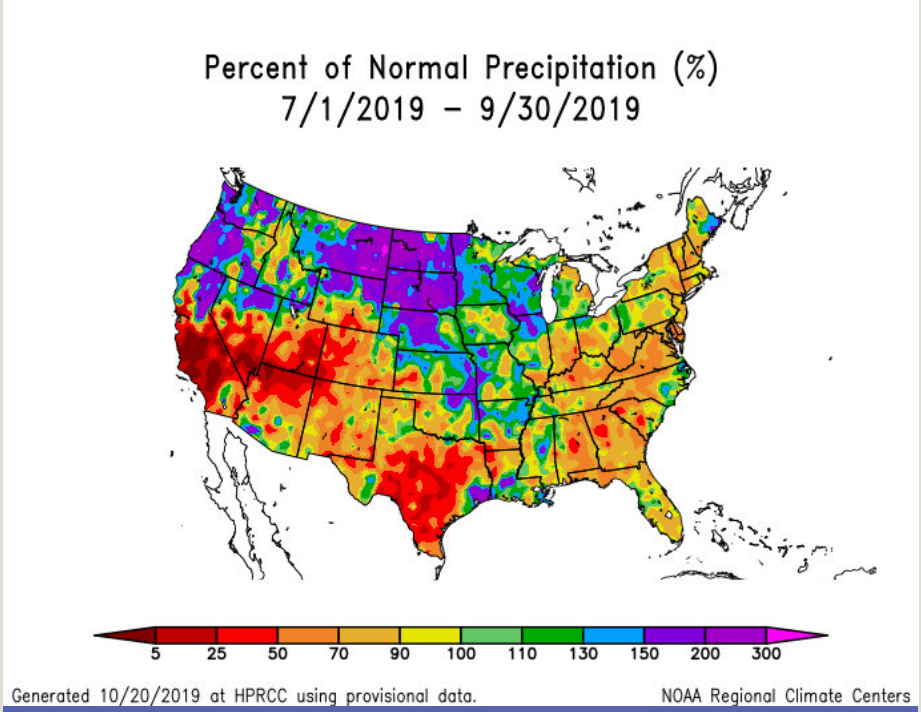
The population affected by drought also rose dramatically throughout the quarter, from 12.3 million people at the beginning of July to 60.8 million by the end of September. The number of people in areas with severe and extreme drought also increased, from 2.1 million to 22.7 million and from 12,000 to 4 million, respectively.

Precipitation

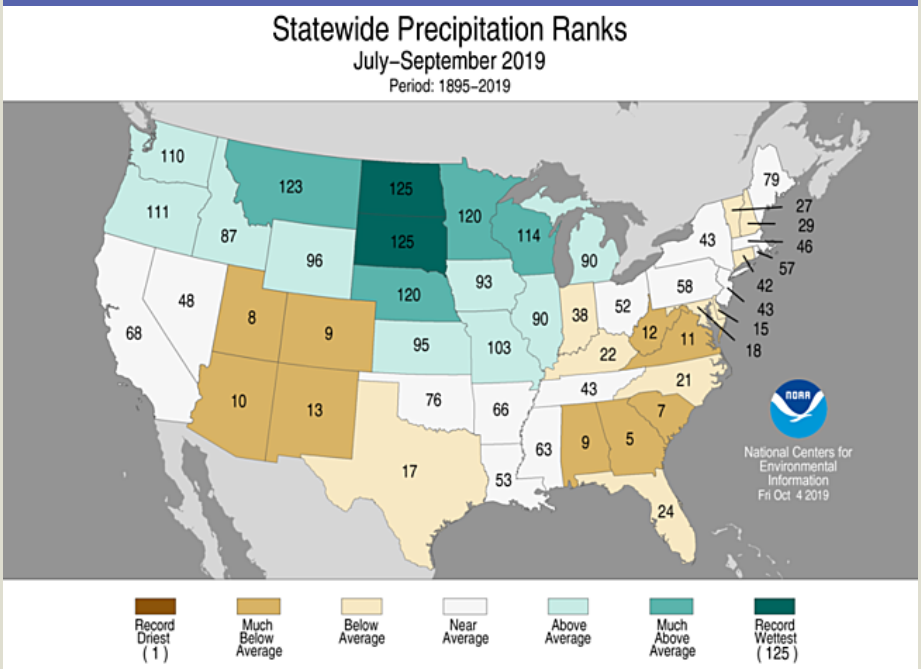
Relatively large areas within the Pacific Northwest, Montana, the Dakotas and Nebraska saw as much as 300% of normal precipitation during the quarter. As much as two times the normal precipitation fell in northern and eastern Kansas, and in pockets within the South and Midwest. North Dakota and South Dakota each saw their wettest July-September on record while Montana saw its third-wettest and Nebraska and Minnesota saw their sixth-wettest. In contrast, much of southern California, southern Nevada, southern Utah, northern Arizona, western Colorado, western New Mexico and Texas received only 5%-50% of normal precipitation. In the Desert Southwest, this was partially attributed to the slow start of the 2019 monsoon season. Dry conditions were also found along the Ohio River Valley and in the Southeast, where totals were 25% to 90% of normal in most areas. Arizona, Utah, Colorado, Alabama, Georgia and South Carolina saw conditions that ranked within the 10th-driest on record in each state during the three-month period. The dry conditions were the worst in September, when Mississippi, Alabama, Georgia, Florida, Kentucky and West Virginia recorded their driest Septembers on record and Tennessee and Virginia saw their second-driest Septembers on record.

Temperature

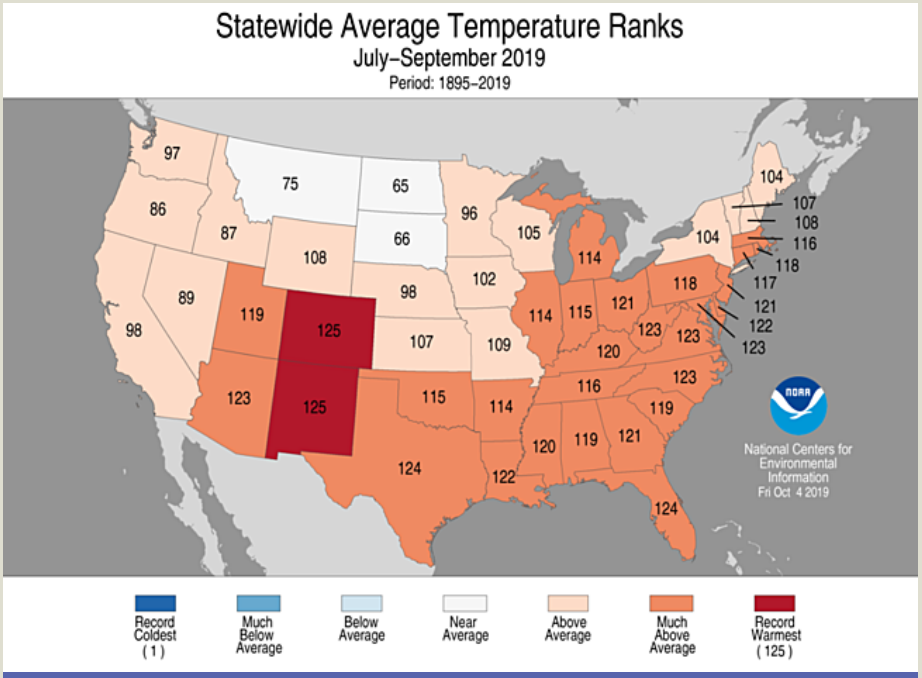
Temperatures were as much as 3 degrees below normal within pockets scattered throughout the West and in the majority of Montana and the Dakotas, but it was a different story throughout the remainder of the country. Temperatures ranged from slightly above normal to 6 degrees above normal for most areas during the three-month period with the Lower 48 recording its fourth warmest July-September on record. The warmest conditions compared to normal were found in Colorado, New Mexico and Texas with Colorado and New Mexico having recorded their warmest July-September on record and Texas seeing its second-warmest. Approximately 20 additional states throughout the Southwest, South,



High Plains Regional Climate Center
Precipitation was above normal in parts of the West, High Plains, Midwest, and South. The driest conditions were found in the Southwest, Texas, and Southeast.

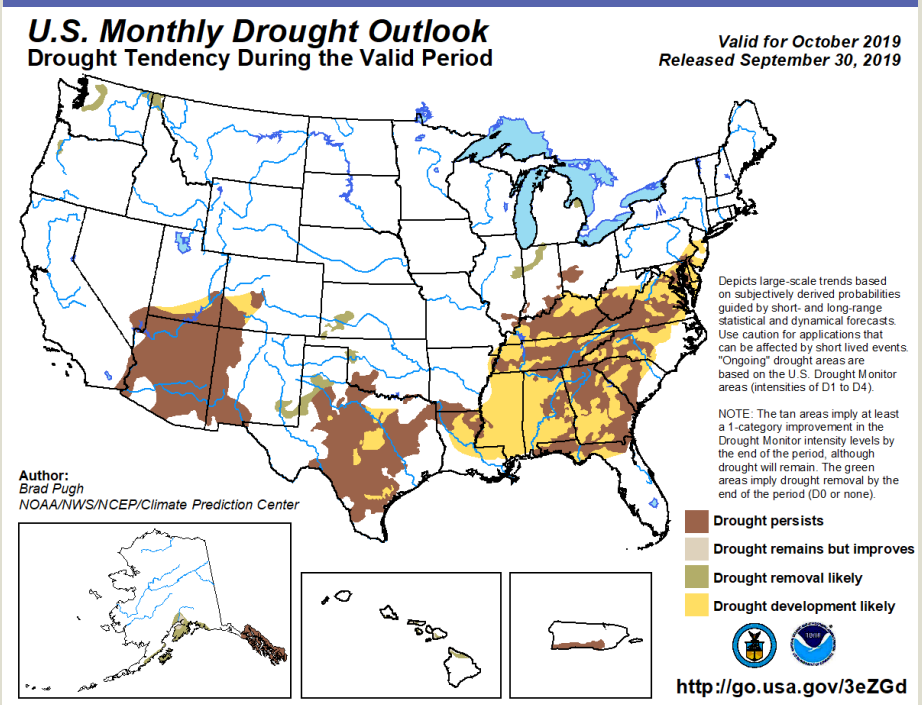


National Oceanic and Atmospheric Administration's Climate Prediction Center
Very dry conditions were found in the Southwest, Texas, and the Southeast in July-September.



National Oceanic and Atmospheric Administration's Climate Prediction Center

Record and near-record heat was found throughout much of the country during July-September.



National Drought Mitigation Center

Drought relief is expected throughout the eastern U.S. while drought persistence and development is forecast for parts of the West and Southern Plains.

Southeast, Midwest and New England recorded temperatures ranked within the top 10 warmest on record for the three-month period. The worst of the heat occurred in September, when temperatures were as much as 10 degrees above normal in areas east of the Rockies and in Colorado. New Mexico, Texas, Louisiana and Ohio recorded their warmest September on record and Kansas, Oklahoma, Missouri, Arkansas, Mississippi, Kentucky and West Virginia saw their second-warmest on record. Furthermore, another 12 states saw temperatures during September ranked in the top five warmest on record. The warm conditions in September followed warm temperatures ranked within the top five on record in New England in July and in the Southwest in August.

Outlook

Drought improvement and even removal is likely across the Southeast, Midwest, Mid-Atlantic, eastern Texas, Louisiana, Arkansas, central Colorado, Alaska and Hawaii in the coming months. In contrast, drought is expected to persist throughout the Desert Southwest, central Texas, Kansas, Oklahoma and southern Puerto Rico. Drought is also likely to develop in parts of northern and central California.

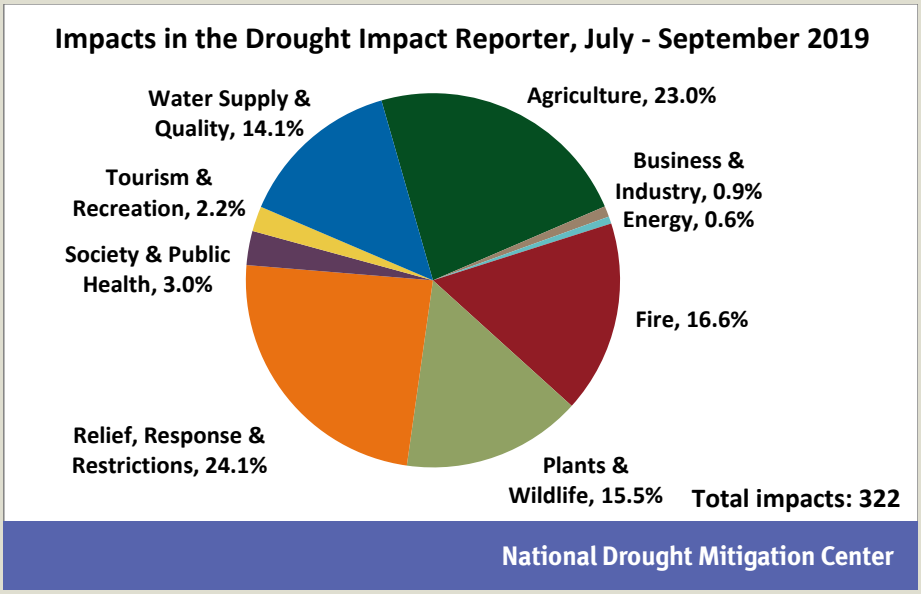
MONTHLY DROUGHT AND IMPACT SUMMARIES

For a more detailed review of conditions, please visit:
drought.unl.edu/Publications/MonthlySummary.aspx

Flash drought spread in Southeast in September after drought increased in late summer

By Denise Gutzmer
NDMC Drought Impact Specialist

In the third quarter of 2019, the National Drought Mitigation Center added 322 impacts to the Drought Impact Reporter. The number of reported impacts increased each month, from 88 in July to 192 in September, when a brutal flash drought spread across much of the Southeast, and portions of Texas and the Southwest endured another hot, dry month. Texas documented 74 impacts in the quarter, describing agricultural concerns and continued fire danger. Alabama and Alaska followed with 27 and 26 impacts, respectively.



Texas crop, livestock concerns; fire danger

Parts of southern Texas were dry as July began, and the aridity spread as the summer progressed with agricultural concerns and burn bans mounting. In August and September, drought expanded significantly, damaging crops and pastures. Some livestock producers began offering livestock supplemental feed or sold livestock, as reported by Texas A&M AgriLife. Calves were weaned early and sold.

Cattle prices dropped as the state beef herd hit an eight-year high of 4.65 million head, and drought caused producers to cull cattle earlier and deeper than usual, according to The Eagle in Bryan, Texas.

With the landscape becoming drier, burn bans became more common throughout August, with 67 of Texas' 254 counties having burn bans on Aug. 2. The number increased to 153 counties on Aug. 30, with requests for the public to be cautious with fire outdoors, per AgriLife Today.

Widespread drought issues in Southeast

Pastures and livestock

Flash drought dominated the Southeast in September. The lack of rain browned pastures, leaving livestock producers dipping into hay supplies early, which may mean hay shortages during the upcoming winter. In addition, farmers got fewer cuttings of hay. Water sources were low in some areas, forcing farmers to haul water for livestock.

Row crops

Late-planted crops were most affected by the drought throughout the southeastern U.S., although earlier-planted ones fared better. Such was the case in central and eastern Kentucky, where corn and soybean yields were down, according to The Paducah Sun.

Heat and drought damaged Virginia tobacco, adversely affecting quality and quantity, as the Danville Register Bee reports. Buyers warned that they would not buy or would offer lower prices for browned tobacco.

In North Carolina and other areas, the soil was too dry for planting fall crops, reported the Winston-Salem Journal. Soybean pods did not fill well, and beans were small.

Peanut growers across the Southeast had a difficult time harvesting crops as the dry soil reduced yields because the legumes could not be extracted easily. In southeast Alabama, WTVY-TV reported that yields were 3,200 pounds per acre, down from the 4,100 pounds per acre the previous year. Peanut growers experienced similar harvest difficulties from Alabama and the Florida Panhandle, up through the Carolinas.

Water supplies

The low flow of the Kentucky River posed problems for those relying on the river for drinking water, according to The State-Journal in Frankfort, where the water had a foul taste and odor, but was safe to drink. Some communities in southern West Virginia and western North Carolina were conserving water.

Increased fire risk

Drought and heat increased the fire danger in the Southeast, causing an uptick in fire activity. While fall is typically fire season for some parts of the country, drought dramatically elevated the fire risk, prompting a large number of drought-driven burn bans in Texas, parts of the southern Midwest and across the Southeast.

In Alabama, the state Forestry Commission issued a Fire Danger Advisory for all counties on Sept. 16, and upgraded the fire danger advisory to a statewide fire alert on Sept. 25, according to the Dothan Eagle.

Dry conditions led West Virginia Gov. Jim Justice on Sept. 20 to issue a statewide burn ban on most outdoor burning, due to drought and limited water supplies in some communities, according to The Associated Press.

The Georgia Forestry Commission reported that there were 626 wildfires in the state in September, 300 % higher than the five-year average. There was no statewide burn ban, per WSB-TV in Atlanta, but the GFC was issuing fewer burn permits.

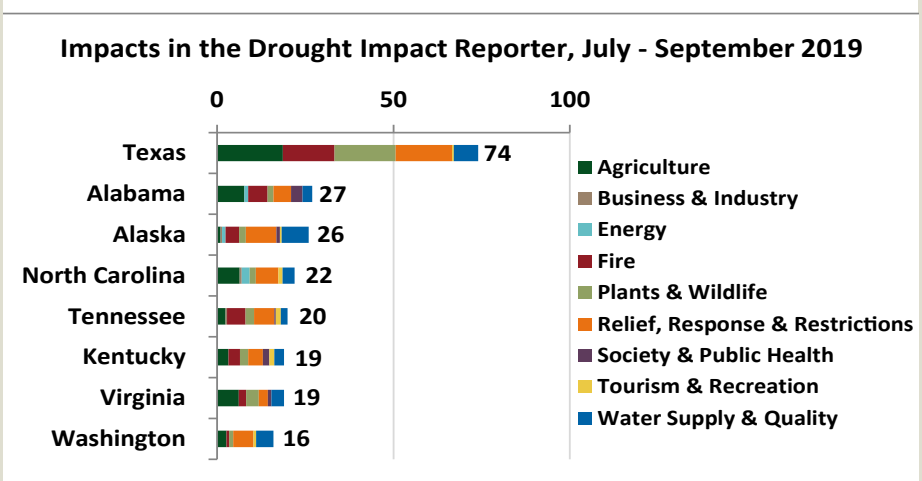
By the end of September, the list of counties with burn bans was growing in south central and southwest Virginia, as listed by WDBJ Roanoke News, as the state prepared for a harsh wildfire season.

Alaskan wildfires, water shortages

Drought contributed to a spate of wildfires in Alaska in July, triggering numerous burn bans and canceled Fourth of July fireworks displays, as reported by KTVA in Anchorage. Kenai Peninsula farmers had to step up the irrigation, and some wells went dry, according to KBBI.

By August, water supplies became an urgent concern for some Alaskan communities as reservoirs were severely depleted. The Chilkat Valley News in Haines, Alaska, reported that mandatory water restrictions took effect there, and KTUU-TV in Anchorage reported that emergency air shipments of water were delivered to the village of Nanwalek. Other Alaskan communities were dealing with water shortages also.

Some of the drier parts of south-central Alaska were ravaged by late-season wildfires, burning about 2.5 million acres statewide from the start of the year through Aug. 19, as reported by Reuters. The blazes consumed homes, necessitated evacuations, forced road and school closures and blanketed the more populous parts of the state in heavy smoke.



National Drought Mitigation Center

Disappointing Southwest monsoon

This year the summer monsoon did not deliver the typical rainfall that the Southwest U.S. typically receives. The monsoon season runs from June 15 through Sept. 30 and can bring up to half of Arizona and New Mexico's annual rainfall. Southwest Colorado often benefits from the summer rains as well, but did not this year, leaving the region trending toward drier conditions and drought expansion as a number of cities across the Southwest had their driest monsoon seasons on record, as reported by The Associated Press.

For more details, see the Drought Impact Reporter.

DROUGHT IMPACT REPORTER

For more detailed reports, visit **droughtreporter.unl.edu**

Flash drought spread across the Southeast in August and September, prompting many submissions to the Drought Impact Reporter. "The dust is horrible," Melinda Rooks of Mountain Branch Cattle in Lamar County, Georgia, wrote in September. "We have not seen good rains in weeks." Courtesy Melinda Rooks.

NDMC's Haigh finds ranchers delayed response to drought

By Cory Matteson
NDMC Communications Specialist

A 2016 flash drought hit areas of Nebraska, Wyoming, Montana and South Dakota (pictured) hard. National Drought Mitigation Center research specialist Tonya Haigh surveyed rangeland managers about their responses to the drought and the findings were recently published. Courtesy of Joe and Cindy Painter.

When rangeland managers see signs of drought, they may need to take action. During a significant flash drought that began in the early spring of 2016 and took hold in parts of the Northern Plains, 87% of managers who responded to a survey created by Tonya Haigh at the National Drought Mitigation Center said that they bought extra hay, grazed pastures earlier, or destocked herds.

But many of those surveyed did not begin taking action until the fall of 2016, even as the drought grew severe months earlier, and even as drought early warning and monitoring information sources such as the U.S. Drought Monitor and products from the National Weather Service and U.S. Department of Agriculture showed signs of drought developing earlier in the year.

Haigh, a research specialist with NDMC, wrote that this offers an opportunity to understand proactive decision-making and improve outcomes for rangeland managers in a study, "Drought Early Warning and the Timing of Range Managers' Drought Response," that was recently published in "Advances in Meteorology."

"It's important to understand the decisions rangeland managers make during drought in order to provide drought early warning information that is relevant and actionable to them," Haigh said.

The study utilized information from a survey of agricultural producers in Nebraska, Wyoming, South Dakota and Montana who were affected by the flash drought that began to develop in late March of 2016. Participants were asked to indicate drought conditions (plant stress, decreased topsoil moisture, etc.) that occurred on their land, what steps they took in response to drought conditions and to estimate the degree to which the drought harmed productivity in terms of several categories, including pasture hay yield, range health and animal reproduction. They were also asked which sources they consulted for drought information, and how influential they considered those sources to be. Finally, they were asked if they would have acted earlier or differently had they received information that told them that the 2016 drought was starting and if they believed doing so would have lessened harm to their operation.

Though producers observed drought conditions such as decreased forage productivity over time as drought developed, the study found that producers did not immediately begin taking action. In addition, "external warnings did not influence the timing of their decisions, though on-farm monitoring and assessment of conditions did," the study states.

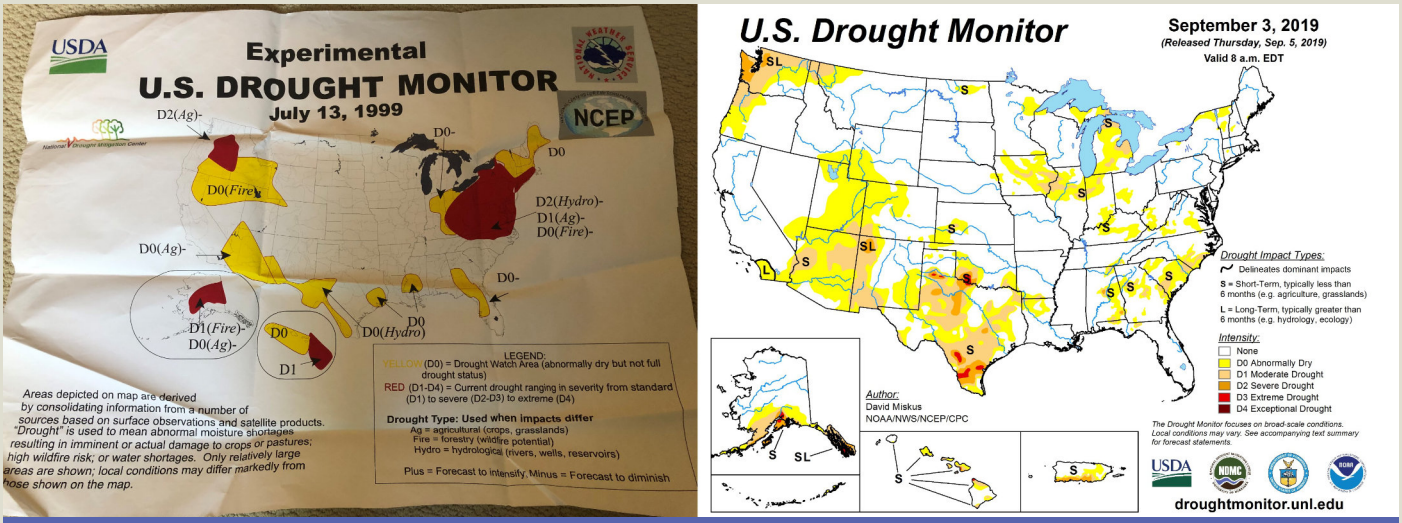
Producers who destocked later in the year saw greater damages to pasture resources, and afterwards reflected that they could have had better outcomes had they responded differently.

"Though this case focused only on a one-year flash drought characterized by rapid drought intensification, waiting to destock pastures was associated with greater losses to range productivity and health and diversity," the study states. "This study finds evidence of unrealized potential for drought early warning information to support proactive response and improved outcomes for rangeland management."

Haigh added: "There is still room to improve proactive drought management on rangelands. Drought early warning information that supports managers' own on-farm monitoring and lessens the uncertainties of decision-making may help close that gap."

"Advances in Meteorology" is an open-access journal, and the entire study is available to view for free online at this link.

U.S. Drought Monitor celebrates its 20th year



The process of creating the weekly U.S. Drought Monitor has evolved over its 20-year history, but its purpose—to show where drought is affecting people in the U.S. and its territories—remains steadfast.

By Cory Matteson
NDMC Communications Specialist

In the late 1990s, National Drought Mitigation Center founding director Don Wilhite assigned Mark Svoboda to find every drought-related index, indicator and tool that existed, and request access to the data that was used to create them. Unfortunately, Google didn't debut until after he began his search.

"There wasn't a whole lot out there, and I remember the response to my request for operational data was getting a hard copy map in the mail of the Palmer Drought Severity Index from the National Climatic Data Center," Svoboda said. "That wasn't even delivered digitally at the time."

With scarcity of information in mind, Svoboda presented on drought mapping at the 1998 American Meteorological Society annual meeting. Another presenter at the session, Douglas Le Comte of the Climate Prediction Center, was interested in combining various drought indices into one map. The two talked after the meeting about joining forces.

"That's where the idea was born to make a higher resolution map made from combining several indicators together that shows where drought is and how severe it is," said Svoboda, who is now the NDMC director.

Their collaboration spearheaded the creation of the U.S. Drought Monitor, which celebrates its 20th anniversary this year. Every week since the Drought Monitor was unveiled at a White House press conference on Aug. 11, 1999, the NDMC, U.S. Department of Agriculture (USDA) and the National Oceanic and Atmospheric Administration (NOAA) have teamed up to release an update of the USDM.

An extensive network from an array of agencies has contributed data and on-the-ground observations to produce more than 1,000 maps, and the USDM has grown to include all U.S. states and territories, including the additions of the U.S.-affiliated Pacific Islands and the U.S. Virgin Islands in 2019. It has triggered billions of dollars in federal aid and low interest loans. Federal, state, tribal, local and basin-level decision makers use it to detect emerging droughts.

And it all started as a map made with CorelDRAW 8.

"I think I have a curled-up map that actually shows one of the original drafts of the Drought Monitor," Le Comte, now retired from the CPC, recently said from his Arlington, Virginia, home. A few minutes later, he found the map.

Dated July 13, 1999, the prototype features some classifications familiar to those who have used the USDM over its 20-year existence. Yellow blobs indicating abnormally dry areas covered much of the Southwest and Northeast. Encircled in red were portions of the Pacific Northwest, Alaska, Hawaii, the Northeast and the Mid-Atlantic, including all of Maryland, Virginia and Washington D.C. These were the only two colors on the draft, though, with red being an all-encompassing indicator of drought. (Each level of drought now has its own designated color.) Arrows specified the class and types of drought in those locales, with one pointed directly at our nation's capital. That drought, the USDM's early authors believe, helped provide the project with a big green light.

"Serendipity is the word," Le Comte said.

Not long after creating that mid-July map, a secretarial briefing regarding the USDM was held at the White House. The USDM's proponents told officials that it could help heighten awareness of drought as an environmental hazard, provide the public and decision-makers vital information about the creeping disaster and decrease response lags to drought, like the rare one building in the Northeast in the summer of '99.

"The Palmer wasn't showing that drought evolving nearly fast enough," said Svoboda, who was a USDM author for 17 years. "Our new prototype showed potential to pick up the signal earlier given we weren't solely relying on any one drought indicator in particular. So they informed us that this new prototype drought indicator was going to go operational this summer. After production of the first operational map in early August, the very next week, the experimental label was off the map. So I think that might be the shortest experimental product in government history. That drought is really what made it all happen, in a way. So we quickly ramped up from two authors to six authors in the span of just a few months."

The first six USDM authors were Svoboda and Michael Hayes from the NDMC, Le Comte and Rich Tinker from NOAA's Climate Prediction Center (CPC), and Brad Rippey and David Miskus, who was on assignment from the CPC at the

USDA, where he joined Rippey. Nearly 30 authors have taken two-week shifts creating the map over its 20-year history. Since late 2000, once the map is released each Thursday at droughtmonitor.unl.edu, the author's name has been included alongside it. Tinker (135 shifts), Miskus (122) and Rippey (96) have authored the most so far.

The map is now created with GIS software, and authors consider data from more than 50 sources, including precipitation, temperature, evapotranspiration, the Palmer Drought Severity Index, the Standardized Precipitation Index, soil moisture indicators, hydrologic data, snowpack data, satellite-based assessments of vegetation health, land-data assimilation models and many more. Some of those sources have been vital to the map's creation since its early stages, when the final drought report was essentially hand-drawn onto the maps utilizing late-'90s graphic design software.

"Maps all over my desk," Svoboda recalled. "Maps on the floor. And you're trying to piece them together in your head. That's hard to do for 50 states in just over two days. Once you get into GIS, everything's digital. You can overlay those together and make a much quicker assessment of the situation. You really start to see the patterns and determine where they agree or disagree. And the subject matter expertise is vitally important when those areas diverge to determine which indicators are going to be the best ones telling the story."

Le Comte said he realized early on that the map was going to be a vital tool when he saw versions of it broadcast on the Weather Channel and reprinted in The New York Times, USA Today, The Washington Post and elsewhere.

"It is really something I enjoyed doing," Le Comte said. "I felt like a little bit of a pioneer doing this, because it was a feeling that this is something important, and that probably would be widely used if done correctly."

Rippey saw the first sign that the weekly publication could be a vital aid trigger in late 2002, when then-USDA Chief Economist Keith Collins invited him to his office in the midst of a drought in the High Plains.

"They said we've got this drought going on, and we've got some nonfat dry milk to give away to these drought-ravaged producers," Rippey recalled. Rather than base the program eligibility on state-level pasture condition reports, as had happened previously, Collins authorized the USDM to trigger aid for livestock producers with the 2003 Surplus Non-fat Dry Milk Sales for Feed Program.

"And that was the first time that anybody in a position to make high-level decisions had come to me as an author and asked if we should use the Drought Monitor (as a trigger), and I said yes."

– Brad Rippey

"And that was the first time that anybody in a position to make high-level decisions had come to me as an author and asked if we should use the Drought Monitor (as a trigger), and I said yes," Rippey said.

In the summer of 2006, with nearly half of the U.S. experiencing drought, attention once again turned to the USDM's drought designations as a trigger for aid in the form of $50 million in state block grants for livestock producers. The USDM has been written into the Farm Bill since 2008 as a trigger for drought relief under the Livestock Forage Disaster Program, and after widespread drought in 2012, it became a trigger for fast-track Secretarial Disaster Designations. As of 2019, the USDM had been used to distribute approximately $7.2 billion in aid to livestock producers. The USDM helps producers receive aid faster, said Brian Fuchs, NDMC Monitoring Coordinator and USDM author since 2006.

"Back in the early days when USDA would try to have these different aid programs, a lot of times it was tied to the Palmer Drought Severity Index, and that's a monthly tool at that," Fuchs said. "With the Drought Monitor being this consolidation of evidence, you're getting that signal and the information is coming through more rapidly because of all the different tools that we're using, and you're getting the best of all the indicators and not relying on a single indicator."

Along with multiple datasets, USDM authors have come to rely on the team of local, state and regional experts on the Drought Monitor network listserv, where climatologists and evaluators provide updates from their locations and also respond to drafts of the map as publication dates near. They often also share news stories about experiences of drought, like a village in Alaska that recently ran out of stored water as the state grappled with persistent drought throughout 2019.

"I think if the Alaska drought that is going on now had happened 20 years ago, we might have missed it," Rippey said. "There's no drought that's going to happen anymore without somebody knowing about it. And that's a good thing."

Svoboda said that as computing evolves and allows for further combination of drought indicators using deep learning, that will add to the Drought Monitor process, but not override it.

"I think we have a process called the Drought Monitor," he said. "It also involves ownership of people on the ground, those 420 or so evaluators that are now part of the Drought Monitor network. Once they felt that they have a voice, and they have ownership, then we had the buy-in and credibility on the ground, and no single indicator or model integrated validation on the ground better than the USDM."

Added Fuchs: "It's this process of data and people coming together, and the end result is the map."

U.S. Drought Monitor now offers tables showing drought impacts at state level

By Cory Matteson
NDMC Communications Specialist

Over its 20-year evolution, the U.S. Drought Monitor has provided a weekly summary of drought conditions across the country and, over time, all of the U.S. territories as well. With each dispatch, the USDM points out areas that are experiencing varying categories of drought, from abnormal dryness (D0) to exceptional drought (D4). Along with the map, the USDM has offered a table of what impact those different levels of drought can cause across a landscape, from slow pasture growth in D0 to widespread crop loss in D4.

But drought looks different across the country's nearly 3.8 million-square mile span, which the National Drought Mitigation Center captures with a new set of USDM tables that reflect drought impacts at state levels. The project, led by NDMC research assistant Mary Noel, provides localized drought impact tables for all 50 states and Puerto Rico and is now available to the public on the USDM website.

"It really supports all the pillars of drought planning," said Noel, who recently graduated with a master's degree from University of Nebraska-Lincoln School of Natural Resources. "It connects the impacts and assessments to monitoring pillars. It connects impacts to mitigation. If you don't know what's actually occurring in that state, then how do you know what to plan for and how to help out?"

The tables offer information that includes the often-considered agricultural impacts of drought, while also listing key impacts outside of that realm. In severe drought (D2), house foundations in Alabama may crack, Connecticut golf courses begin to conserve water and dust storms may sweep across New Mexico. In extreme drought (D3), the health of Nevada's wild horse population is likely to deteriorate, leading officials to round up and relocate them to less impacted areas.

"They're all unique, which is a great outcome," Noel said of the tables. "We really wanted these tables to bring awareness to these underrepresented sectors that are affected by drought. The goal is twofold. One goal is for the users of the U.S. Drought Monitor to understand what this level of severity actually means for their area. The other is for the USDM authors to help them better understand what category of drought they should label a place. So it's both the users and the authors who can utilize these tables."

National Drought Mitigation Center research assistant Mary Noel presented on the creation of state impact tables for the U.S. Drought Monitor at the USDM Forum in Bowling Green, Kentucky.

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> – Mary Noel

The localization effort, which was Noel's master's research project, won first place for poster presentation at the American Meteorological Society's 2019 annual meeting. Noel recently presented on the project at the U.S. Drought Monitor Forum in Bowling Green, Kentucky, one day after the tables debuted on the USDM website. Noel said session attendees approached her afterwards with numerous questions, many centered upon the prospect of expanding upon the research in their own disciplines.

That's been the plan all along, she said, since NDMC director Mark Svoboda and monitoring coordinator/USDM author Brian Fuchs discussed the idea of creating state-specific tables with her after she enrolled in graduate school in her hometown. Noel graduated with a bachelor's degree in earth sciences from California Polytechnic State University-San Luis Obispo in 2017, spending her undergraduate years in a state that experienced drought the entire time she lived there.

To create the state impact tables, Noel focused on one drought event in each state, gathering information from entries in the Drought Impact Reporter, a database created in 2005 to collect on-the-ground reports about emerging droughts. DIR impacts reported during the onset of the selected drought events were downloaded, coded and cross-

referenced with the USDM's drought severity levels at the time the impacts were reported. Beginning the sizable undertaking alphabetically, Alabama was the project's pilot state.

"We linked from the U.S. Drought Monitor to the impacts so you knew dryland farming stress happens at a D1 level in Alabama," Noel said. "We analyzed all those impacts and the severity levels when they occurred, synthesized them together and formed a concise, easy-to-read and understandable list of impacts that occurred in Alabama for the different severity levels."

Noel then fact-checked the tables with stakeholders in Alabama to confirm that the impacts found during data collection were accurate.

"Mary really embraced this idea that, if you could get feedback from the local stakeholders, it would enhance the tables even further than what she was doing herself," said NDMC climatologist Michael Hayes, one of Noel's advisors on the project.

Noel said that 89 participants from 33 states and Puerto Rico provided vital "ground truthing" for the project.

Hayes said that the effort will help provide key context for residents of a state where drought is developing, as well as for non-residents whose notion of drought impact is based upon their experiences elsewhere.

"For instance, the state of Washington has had a drought event in 2019," Hayes said. "Having a table tailored for Washington, or a table tailored for any other state that's having a drought event, is going to be much more relevant than a national overview table. If you can make a table more specific for where drought is actually occurring, I think that's where the benefit is. And it illustrates again that drought is going to be different where it occurs around the country. In theory, it'd be awesome to have tables for every county."

While a set of county-level impacts might not happen in the near future—there are more than 3,000 of them in the U.S., after all—Noel said the state impact tables were released this month with the expectation that they will be updated and evolve.

"I'm really excited that this project was actually implemented," she said. "People want to use it, and it can be used, which I think is the whole purpose of science."

NDMC director contributes to United Nations drought project

By NDMC Communications

Drought-smart land management (D-SLM) is a key means of preventing famine, crop loss, land degradation and other effects of drought around the world, and will help reduce both carbon emissions and vulnerability to climate change. Mark Svoboda, director of the National Drought Mitigation Center at the University of Nebraska-Lincoln, coauthored recommendations on the land-drought nexus presented as part of a Drought Toolbox at a United Nations meeting in New Delhi, India, in September 2019.

Svoboda was part of the United Nations Convention to Combat Desertification - Science Policy Interface team that coauthored two documents presented at the 14th session of the Conference of Parties, "The Land-Drought Nexus," and "Land Management and Drought Mitigation." The international group includes both scientists and policy makers, and its mandate is to advise the UNCCD in its mission. Svoboda was named to the Science Policy Interface in early 2018.

The documents list specific steps for promoting healthy soil for crops, grazing lands, forests and woodlands, and mixed land uses. Takeaways listed in the Nexus Executive Summary include: Human decisions have a big impact. There are strong links between the drought-land nexus and human decisions on land use and land use change which impact water availability and determine ecosystem and human resilience to drought.

Healthy soils store water. Whereas healthy soils can store water that functions as a buffer in times of drought, human-induced land degradation reduces soil water holding capacity and amplifies water scarcity and increases the vulnerability to droughts.

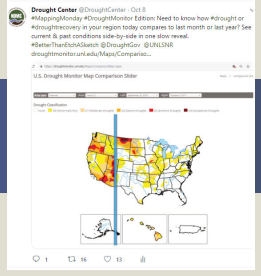
Prevention is more effective than response. Policy approaches and actions seeking to provide ex-post relief to drought-affected populations and economic activities are less effective than proactive actions utilizing drought risk management measures to mitigate the effects of drought.

The multi-day conference included a Drought Preparedness Day, Sept. 11.

Read more:

- UNCCD COP14
- Land and drought
- The Drought Initiative
- The Drought Toolbox

NDMC on the web



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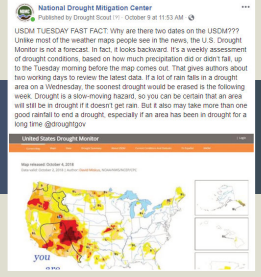

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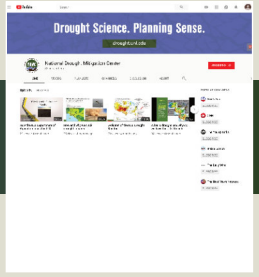


Tune in with us on YouTube:
go.unl.edu/droughtflix

Drought Risk Atlas updated through 2017, with 50% more stations

By NDMC Communications

The National Drought Mitigation Center rolled out a major update of the Drought Risk Atlas (DRA) Oct. 13, with drought indices computed through 2017 based on 50% more stations, now including Alaska and Hawaii. The update includes data from 1,124 more weather stations and 434 Snowfall Telemetry (SNOTEL) sites, as well as the 3,059 stations that were part of the original launch in 2014.

The DRA provides a way to look back in time, to understand how frequently and how badly a particular location has been affected by drought. For most climate stations, the DRA provides:

- precipitation and temperature measurements
- Standardized Precipitation Index
- Standardized Precipitation and Evapotranspiration Index
- Palmer Drought Severity Index
- self-calibrating Palmer Drought Severity Index
- U.S. Drought Monitor
- drought periods
- comparison of indices
- frequencies

Each of the numeric indices can be expressed as a time series, a table, analog ranks, or a heatmap.

Including the U.S. Drought Monitor in the DRA makes it easy to compare current conditions with past conditions, said Brian Fuchs, leader of the NDMC's Monitoring group.

"That's what people always ask," he said. "How does this drought compare with what has happened in the past?"

The pre-computed indices in the DRA mean that users can go download a pre-computed drought history for a station near them, and then start preparing for drought by remembering or asking what impacts occurred during previous drought periods, and what would happen if a similar drought occurred again in the near future.

Adding more stations means that it will be easier for more users to find a station near them. To add stations, the NDMC consulted with state climatologists and others about how much of a gap in the records was too much. To be included, stations must have at least 40 years' of data, data gaps no bigger than two consecutive years, and no more than five data gaps in the past 40 years.

An update of the Drought Risk Atlas includes data from 1,124 more weather stations and 434 Snowfall Telemetry sites, as well as the 3,059 stations that were part of the original launch in 2014.

> "That's what people always ask. How does this drought compare with what has happened in the past?"
>
> – Brian Fuchs

Most of the data is from the National Weather Service Cooperative data network, archived in the Regional Climate Centers' Applied Climate Information System (ACIS). The update also includes data from SNOTEL sites, which collect data about snowfall as well as temperature and precipitation. SNOTEL sites are operated by the Natural Resources Conservation Service.

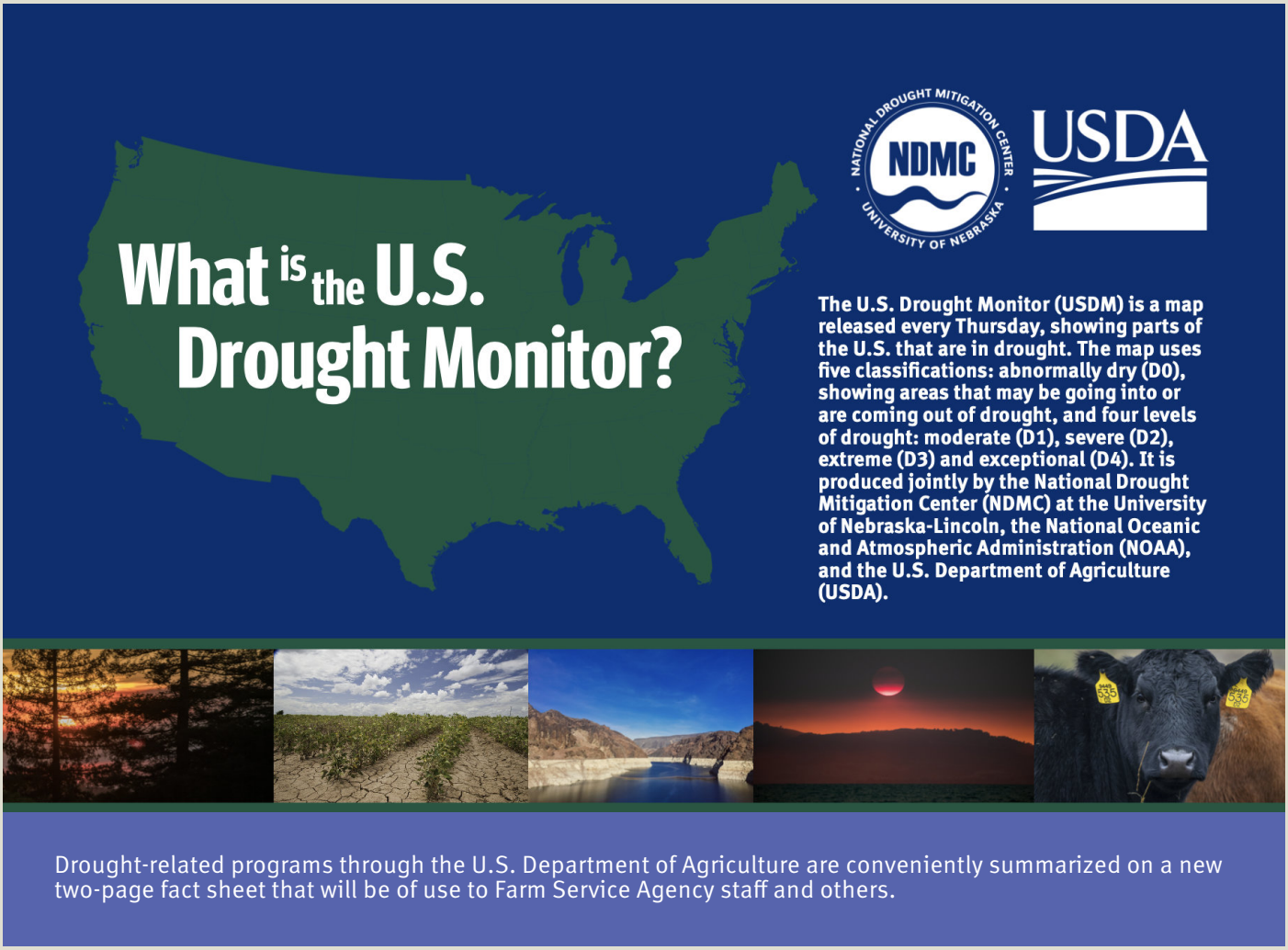
The NDMC, which is based in the School of Natural Resources at the University of Nebraska-Lincoln, was supported in this work by the Drought Risk Management Research Center, a Coping with Drought project funded by the Sectoral Applications Research Program of the National Oceanic and Atmospheric Administration and the National Integrated Drought Information System.

Research currently underway focuses on figuring out an ideal schedule and process for future updates, to maintain the DRA with more current data, Fuchs said.

Want expert help choosing a drought indicator? Visit the Handbook on Drought Indicators and Indices at http://www.droughtmanagement.info/indices, although all the computations in the DRA mean that the index of your choice is ready to use, pre-computed for you from the data.

Find the Drought Risk Atlas online: droughtatlas.unl.edu.

New fact sheet lists USDA's drought recovery resources



Drought-related programs through the U.S. Department of Agriculture are conveniently summarized on a new two-page fact sheet that will be of use to Farm Service Agency staff and others.

By NDMC Communications

Drought-related programs through the U.S. Department of Agriculture are conveniently summarized on a new two-page fact sheet that will be of use to Farm Service Agency staff and others.

"This is a convenient all-in-one resource that will help producers access resources for drought recovery," said Brian Fuchs, Monitoring coordinator at the National Drought Mitigation Center at the University of Nebraska. The NDMC and USDA jointly assembled the fact sheet.

Recovery programs triggered by the U.S. Drought Monitor:

- Livestock Forage Disaster Program (LFP)
- Emergency Assistance for Livestock, Honeybees, and Farm Raised Fish Program (ELAP)
- Emergency Loan Program, for producers in counties eligible under Fast-Track Secretarial Disaster Declarations
- Other USDA drought recovery programs:
- Non-Insured Crop Disaster Assistance Program (NAP)
- Livestock Indemnity Program (LIP)
- Emergency Haying & Grazing – Conservation Reserve Program (CRP)
- Emergency Conservation Program (ECP)
- Tree Assistance Program (TAP)
- Drought recovery programs through the Natural Resources Conservation Service:
- Environmental Quality Incentive Program (EQIP)
- Emergency Watershed Protection Program (EWP)

Crop insurance is available through the Risk Management Agency.

Each of the numeric indices can be expressed as a time series, a table, analog ranks, or a heatmap.

The fact sheet also lists other resources and websites that may be of use to producers who are coping with drought. Read the fact sheet here. ❍